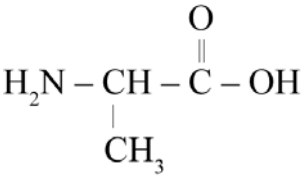
Constitutional isomers and stereoisomers

1) The amino acid alanine below can exist as two enantiomers (optical isomers).



i) Draw three-dimensional structures for the two enantiomers that clearly show the relationship between them.

ii) Alanine has two straight chain isomers that do not show acidic properties. One of these isomers, **P**, can exist as an enantiomer, the other isomer, **Q**, cannot. Draw **P** and **Q.**

iii) Explain why **P** exists as an enantiomer.

2) An alcohol **A** with the molecular formula $C_4H_{10}O$ can exist as enantiomers (optical isomers).

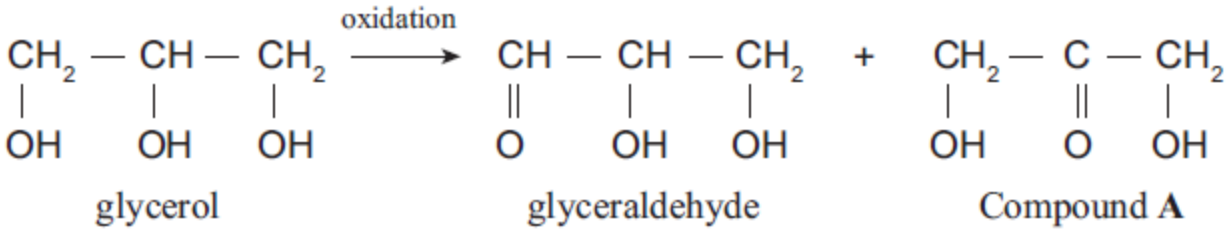
i) State the structural requirement for a molecule to be able to exist as enantiomers.

ii) Describe a property of enantiomers that would enable them to be distinguished from each other.

iii) Draw the structural formulae of the enantiomers of alcohol **A**.

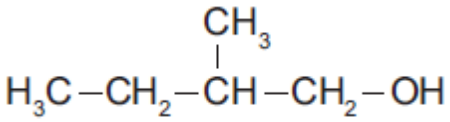
3) Compound A is a carboxylic acid with the molecular formula $C_4H_8O_2$. Identify an isomer of Compound A that can exist as a pair of enantiomers (optical isomers) and justify your choice

4) i) Draw a circle around the product of the reaction below that will show optical isomerism (exist as enantiomers). Give a reason for your answer.



ii) Explain how the two enantiomers of the compound circled above could be distinguished from each other.

5) $C_5H_{11}OH$ is an example of an alcohol that can exist as a number of different isomers.
a) Draw structures of the isomers of $C_5H_{11}OH$ that satisfy the requirements of
i) a branched-chain secondary alcohol **(A)** and **ii)** a branched-chain tertiary alcohol **(B)**

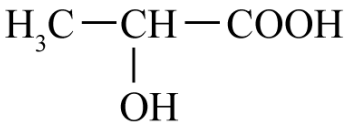


b) Explain why is the only primary alcohol isomer of $C_5H_{11}OH$ that is able to exist as a pair of enantiomers (optical isomers).

6) i) Draw structural formulae for all the possible constitutional (structural) isomers of $C_4H_{10}O$ that are alcohols.

ii) Circle any isomer above that can exist as a pair of enantiomers (optical isomers).
iii) Explain what physical property would allow the two enantiomers to be distinguished.

7) Lactic acid is the common name for 2-hydroxypropanoic acid. Lactic acid can exist as enantiomers (optical isomers)



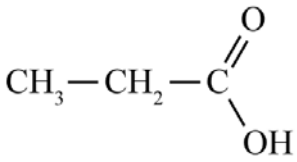
a) Draw three-dimensional structures for the two enantiomers of lactic acid that clearly show the relationship between them.

b) Compound **X** is a structural isomer of lactic acid. Compound **X** will turn blue litmus red but cannot exist as enantiomers.
i) Draw the structural formula for Compound **X**.

ii) Explain why this structure cannot exist as enantiomers

8) An alcohol ($C_4H_{10}O$) can exist as **optical** isomers (enantiomers).
i) Draw three-dimensional structures that show the relationship between the two enantiomers.

ii) Draw and name a **structural** (constitutional) isomer of

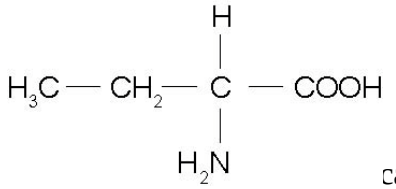


iii) Discuss the differences in chemical and physical properties between samples of these two structural isomers.

9) a) Compound A is an isomer of **C_4H_8O** and can exist as two **enantiomers** (optical isomers). It contains two different functional groups – an alcohol(OH^-) group and an alkene group. Draw 3-dimensional structures for **both enantiomers** that clearly show the relationship between them.

b) Two compounds **(B and C)** have the same molecular formula, C_4H_8O. They are ***cis-trans*** **isomers** that contain a primary alcohol group. Both compounds rapidly decolourise bromine solution. Draw the structural formulae of compounds B and C.

10)



i) Compound can exist as two optical isomers (enantiomers). Draw 3 dimensional structures that clearly show the relationship between the two enantiomers.

ii) Describe similarities and differences in the chemical and physical properties of the enantiomers